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1918

FIRST BIENNIAL
REPORT
OF THE
STATE HIGHWAY
COMMISSION



OF THE
STATE OF MONTANA

1917-1918

INDEPENDENT PUBLISHING CO.
HELENA, MONTANA



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CONTENTS.

	1917	1918
	Page	Page
Introductory	4	18
Analysis of Highway Situation	7	19
Policy of Highway Commission	8	20
Construction and Maintenance Standardization	9	20
Bridge Standardization and Supervision	10	20
Federal Aid Operations and Requirements	12	21
Road Mapping and Records	24
Testing Road Materials	13	24
Accounting and Cost Keeping	13	24
Developing Construction Organizations	13	25
State Aid Operations and Administration	13	25
Developing Appliances	13	27
Information	14	27
Federal Collaboration	28
Summary of Major Operations	29
Financial Statement	6	30

**FIRST ANNUAL STATEMENT OF THE HIGHWAY COMMISSION
OF THE STATE OF MONTANA, FROM THE FIRST MONDAY
IN MAY TO NOVEMBER 30, 1917.**

To the Honorable S. V. Stewart,
Governor of Montana.

The State Highway Commission reorganized under Chapter 170 of the Session Laws of 1917, begs leave herewith to submit its first Annual Statement covering operations from its organization on May 7th, to November 30th, 1917, the end of the fiscal year.

The Commission consists of twelve members, one from each of twelve districts into which, under the Statute creating the Commission, the State is subdivided. The members are appointed by the Governor and the appointments run for a period of four years, except that the first appointments are so arranged that the terms of office of three members expire each year following. The counties comprised in each district are as follows:

- No. 1. Lincoln, Flathead and Sanders.
- No. 2. Mineral, Missoula and Ravalli.
- No. 3. Beaverhead, Madison and Gallatin.
- No. 4. Silver Bow, Deer Lodge and Granite.
- No. 5. Lewis and Clark, Broadwater, Powell and Jefferson.
- No. 6. Cascade, Musselshell, Meagher and Fergus.
- No. 7. Chouteau, Teton, Hill and Toole.
- No. 8. Blaine, Sheridan, Valley and Phillips.
- No. 9. Carbon, Stillwater, Sweet Grass and Park.
- No. 10. Rosebud, Yellowstone and Big Horn.
- No. 11. Custer, Prairie and Fallon.
- No. 12. Wibaux, Dawson and Richland.

The following are the members comprising the present Commission:

District		Years
No. 1.	F. H. Johnson	Kalispell
No. 2.	D. T. Curran	Missoula
No. 3.	C. H. Buford	Virginia City
No. 4.	Oscar Rohn	Butte
No. 5.	Frank Conley	Deer Lodge
No. 6.	H. A. Templeton	Great Falls
No. 7.	C. W. Morrison	Fort Benton
No. 8.	A. W. Mahon	Glasgow
No. 9.	Samuel Webb	Columbus
No. 10.	E. A. Richardson	Forsyth
No. 11.	H. R. Wells	Miles City
No. 12.	T. F. Hagan	Glendive

EXECUTIVE COMMITTEE:

OSCAR ROHN

H. R. WELLS

A. W. MAHON

OFFICERS:

OSCAR ROHN, President

H. R. WELLS, Vice-President

A. W. MAHON, Secretary

FINANCES OF THE COMMISSION.

Funds for the work of the Commission are derived from Motor Vehicle License Fees. Under Chapter 75, of the Session Laws of 1917, all motor vehicles operating on the roads and streets of Montana are required to pay a license fee of from \$5.00 to \$15.00 on automobiles, with proportionate fees on motorcycles and motor-trucks. The Act is administered by the Secretary of State and after paying the cost of administration one-fourth of the balance is returned by the Secretary of State to the counties of origin, and three-fourths of the balance is paid into the State Highway Fund. Of this amount the Highway Commission sets aside one-third to be expended under its direction in the counties in which the fund originated. The balance of one-half of the net amount, after paying administration, is set aside for the general expense of the Commission.

For the period covered by this report, namely, May 7th to November 30th, 1917, amounts named were as follows:

Gross return from motor vehicle license fees.....	\$295,060.00
Administration expenses by Secretary of State.....	25,069.03
Amount returned to counties by Secretary of State	62,616.00
Amount to be expended in counties under direction of Highway Commission	66,815.50
Amount available to meet expenses of Highway Commission	132,777.00
Total expenditures of Commission for the period stated amount to	22,627.57
These are distributed as follows:	
General Administration	\$ 5,058.18
Highway Department	7,200.99
Bridge Department	10,368.40

AIMS AND PURPOSES OF THE COMMISSION AND ITS PLAN OF ORGANIZATION.

An analysis of conditions involved in highway improvement in the State of Montana brings to light a number of basic factors that militate against efficiency and success in the work and that are largely responsible for a widespread feeling that, taken as a whole, results obtained in highway improvement are not wholly commensurate with the amounts expended for the purpose. To isolate these factors and provide correctives for them is deemed by the Commission to be the greatest and most far-reaching need of the highway problem. This it proposes to undertake in conjunction with the specific tasks set for it by the Statute under which it is created, which are as follows:

To secure a uniform system of highway improvement throughout the State of Montana. To secure the benefits of Federal Aid under the Act of Congress approved July 11th, 1916, and to give all possible aid, assistance, and advice with regard to road and bridge construction, improvement and maintenance throughout the State of Montana.

Even superficial consideration of the highway situation develops the fact that the problems involved present two separate and wholly distinct classes. The one involves financing and administration; the other involves the direction and conduct of operations.

In the matter of financing and administration there are two conflicting tendencies. The one favoring centralization of control, the other favoring localization of control. Interests looking toward the development of main chain highways connecting the principal trade centers of the State favor centralization of control. Interests looking toward the development of feeders giving good highway service to every part of even remote rural communities favor localization of control. Thus the touring public and interests benefitted by the development of touring trade favor the main through highways. The various agricultural and rural interests in turn favor the local feeder systems giving them a direct outlet to markets.

The framers of the State Government under conditions existing at that time deemed the best solution of this problem to lie in localizing highway control to the extent of subdividing the same by counties. Under this system the county is the unit of control and the problems involved in each county are in the hands of the County Board of Commissioners. Recent agitation looking toward further localization has found expression in an Optional District Law passed by the Fifteenth Legislative Assembly. While this law may have advantages in special cases, a fair consideration of all factors involved in the problem would seem to indicate that the county system as it stands upon the statute books today is a good compromise and perhaps as good a system as can be devised for handling administration and financing. Under this

system it is the duty of the Board of Commissioners of each county to decide upon the amount of money to be raised by tax levy for road purposes and to work out a fair and equitable distribution and application of this money in each county. This makes it possible for each individual taxpayer to come closely in contact with the system and to be heard and specifically considered as regards his interests. On the other hand each unit is of sufficient size to avoid excessive and avoidable expense in needless duplication and also to make it possible to handle the problem of main connecting roads with reasonable efficiency and success.

To preserve this system and its advantages as far as possible and to correct its weaknesses is believed by the Commission to present the best and most satisfactory solution of the problem. And this has been adopted by the Commission as the basic principle upon which to formulate its policies and to plan its work.

As hereinbefore stated, the problem presents two principal phases. One, administration and financing, and two, directing operations. The first class has been discussed. Investigations of the second class lead us to the following consideration: Under the present system each county is divided into road districts and each district is presided over by a road supervisor appointed by the Commissioners.

In the days of exclusive animal traction when road work consisted in clearing the right of way, in filling mud holes, in corduroying bogs and in grading hillsides, this system proved sufficient and quite satisfactory.

With the advent of power-driven vehicles, however, the road problem has undergone a complete change, the means and methods of road construction satisfactory before, no longer suffice and the entire subject presents new and wholly unsolved problems that call for modern engineering skill comparable only with that of railway construction.

In the case of railway construction long years of experience have developed and proved out the best means of solving the difficult problems involved, until today there is generally accepted and established a uniform and standardized system of construction and maintenance. Not only this but thousands of men are trained in every branch of the work so that when railroad construction is undertaken not only are the methods fully established and generally understood, but an unlimited supply of men is available, trained to carry out these established and well understood methods.

In the case of highway construction, while the problems presented are even more varied and complex than those of railway construction no such experience is available. Consideration of the system in common use, as above described, develops the fact that under it no such accumulation of experience can ever develop. This for the reason that the entire supervision of highway work is in the hands of men who are constantly being changed. No sooner does a supervisor, even if com-

petent and painstaking (a condition rather the exception than the rule) begin to accumulate some experience and acquire more or less useful knowledge about his work than someone else is put in his place thus to start anew to acquire experience at the expense of the public. Not only does this apply to supervisors, but it applies to commissioners as well. It is due to this constant and endless change in the entire personnel in charge of highway improvement that there has been made so little progress in working out a widely accepted and uniform system and method of work. A little consideration must furthermore convince any thinking person that under this system no material improvement in the up-building of experience may be expected.

Not only is there no hope under present conditions of building up a system based upon accumulated experience, but ordinarily accumulated experience is not sufficient to meet the demands of the highest success in present day road building. Each of the many different problems involved requires for its best solution thorough going scientific investigation, and such investigation can be conducted satisfactorily only by men especially prepared for the work. To undertake such investigations is quite beyond the ability of any county. On the other hand the work once done will serve equally well the needs of each of the forty-three counties of the State. It is plain, therefore, that this is work that can best and most economically be carried out by a state organization. Upon careful investigation the Commission finds the opportunities offered by this phase of the work so important and so far-reaching that it can in no other way hope to accomplish as much for highway improvement of the State with the funds at its disposal. A systematic, thorough study of these problems by a properly qualified and well organized force offers greater returns at the present time than any other line of endeavor.

Having worked out effective solutions to these various problems the consideration of next greatest importance is to make them available and effective in the conduct of the work. By this policy the Commission feels that it is striking directly at the root of the weaknesses in the present system and is laying the foundation for correcting them in the broadest and most effective possible way.

In carrying out this policy and plan of work the first and most important problem considered was that of working out and deciding upon the methods of road construction and maintenance best adapted to the different conditions found in the State. This is a broad and difficult problem. Opinions regarding the same are as numerous and as varied as men engaged in the work. It is plain, however, that each system used must have some bad and some good features and that from among them all it must be possible to devise one that combines most of the good features and avoids most of the bad ones. With a view

to making a start toward working out such a system the following plan was adopted:

First, the county commissioners and the county engineers of the State were invited to meet with the Commission at a general conference at Helena on July 14th and 15th of the past year. At this meeting, which was well attended, the plans of the Commission as far as then developed, were laid down before those present, and in the resulting discussion much useful and valuable information was developed. It was felt also that a foundation was laid for a closer understanding and for mutual and hearty co-operation between the county officials and the Commission, a factor fundamentally necessary to success in any great degree in the work undertaken.

Growing out of this meeting there was held in July a meeting of men in charge of successful road construction in different parts of the State. There were present at this meeting about twenty-five men. They convened at Butte and spent three days inspecting and discussing completed work in Deer Lodge, Silver Bow and Jefferson Counties, and work under way near Boulder in Jefferson County where the Highway Commission was supervising reconstruction of some twenty-five miles of road. Advantage was taken of this to demonstrate the efficient use of a fairly complete outfit of modern road building equipment.

This meeting accomplished several particular purposes: First, it established a better acquaintance and a more cordial relation among the best road building talent in the State. Second, it served as a clearing house of ideas and made a substantial start toward standardization of means and methods. Third, it established a closer understanding and relation between the Highway Commission and its policies and the men actually in charge of successful road work in the State. Fourth, it put the Commission in touch with men to be associated with it in the prosecution of the work planned.

From among the men present a number have become directly associated with the Commission as a start in developing its organization. Most of the men selected are either members of Boards of Commissioners or County Surveyors in charge of work and not in position to give their undivided time to the work of the Commission. In such cases they have been engaged on a per diem basis to give such time as their positions permit in acting in a consulting and advisory capacity in the district in which they are located. This work of reaching a general understanding regarding best methods of construction and maintenance for Montana—standardizing methods of road construction and maintenance as it were,—must necessarily be an undertaking that will take much time and patience to work out successfully. Yet it is felt that a creditable start has been made and that an energetic prosecution of the policy adopted will give increasingly important results.

An opportunity second only to that above outlined is presented by highway bridge construction of the State. Modern bridge design and construction is a highly specialized branch of engineering. Any good structural engineer can design a bridge, but to be assured of securing a design that will give the best and most satisfactory bridge for the least money, requires the services of a man who specializes in bridge construction and who keeps closely in touch with the most modern developments in the art. Such men are ordinarily not available to the board of Commissioners. The various bridge companies operating in the State are represented by the best and keenest engineers in the business, and these companies bidding each on a design prepared and submitted by themselves leave the Commissioners no satisfactory basis upon which to compare bids, since the designs upon which bids are prepared are not uniform in strength nor in cost.

The correction of this situation demands that the Commissioners have prepared their own designs upon which all bids are based and that they have at their command expert advice as competent and as keen as that of the construction companies who are bidding on the work. Even the most superficial consideration will indicate that one organization properly equipped can give this service to the entire State, and do this at only a small part of the cost of several distinct organizations. The most efficient and most practical forms of designs once worked out for one county in the State will serve every other county in the State for a long time without added expense. It is to furnish to the Boards of Commissioners and to the taxpayers of the State the service outlined in connection with bridge construction that the Commission has organized its Bridge Department. Progress in this department had been made by the former Commission. An organization for the work had been perfected. A number of designs of large steel structures had been worked out and their construction supervised, and a considerable line of plans and specifications for various types of smaller structures had been developed and were on file with the different counties. Advantage was taken of these and the work was carried forward without interruption. It is planned to push this work energetically and to be in position to place at the disposal of the Commissioners of the State the best bridge engineering designs and advice that can be secured.

During the period covered by this report the department has designed and supervised construction of the following:

4	Structures costing over	\$25,000.00
2	Structures costing \$10,000.00 to	\$20,000.00
15	Structures costing \$ 5,000.00 to	\$10,000.00
17	Structures costing \$ 5,000.00 and under	

The total cost of structures designed and supervised by the department during the period named approximates \$225,000.00.

Under an Act passed on July 11, 1916, and known as the Federal Aid Road Act, Congress has appropriated the sum of \$85,000,000 to be expended in the course of five years embracing 1917 to 1921 inclusive on road construction in the different states of the Union. Under this Act, Montana is entitled to approximately the following:

\$ 98,000.00	for the year ending June 30, 1917
\$196,000.00	for the year ending June 30, 1918
\$294,000.00	for the year ending June 30, 1919
\$392,000.00	for the year ending June 30, 1920
\$490,000.00	for the year ending June 30, 1921

making a total of nearly \$1,500,000.00 for the five years. In addition there is another fund known as the "Section Eight" fund under which Montana will receive approximately \$70,000.00 yearly from 1917 to 1926 inclusive.

The application of these funds is hedged in by certain rules and regulations. The first of these is that the State, or a subdivision thereof, must furnish an appropriation for the work equal to that of the Federal Government. The roads built thereunder must conform to certain standards; certain procedure involving surveys, mapping and specifications must be observed. All of the above can be accomplished satisfactorily only by a central organization. In fact the Federal Aid Act provides that its application must be worked out through a State Commission. To carry out this work in the most economical and efficient manner is the third specific purpose of the Commission.

The organization for this work is well started and the work is under way. To date there have been initiated and there are in various stages of development twenty-seven projects in twenty-three different counties. These projects involve an expenditure of \$812,000.00. All of these projects and many others will be ready for construction during the coming season. The expense thus far incurred in the development of these projects has been borne by the State Highway Commission.

It has been definitely determined by the Commission that the proportion of all overhead charges in connection with Federal Aid Projects, including the cost of initiating, reconnaissance, surveying, the preparation of the required plans and specifications, together with all estimates and supervision of construction and the necessary accounting, chargeable to the State or its subdivisions, will be paid from the State Highway Commission funds, thus permitting the entire appropriation by the counties to go into actual construction. This policy will give to the counties two dollars in actual highway construction for each dollar expended by the counties.

Whether or not heavy construction work of this kind should be undertaken during the period of the war is a mooted and much discussed question. On the one hand it is argued that whereas it cannot be claimed that any road work henceforth undertaken can in any material

degree contribute to the prosecution of the war, all such work should be laid over until after the termination of the war, and the labor required by such work should be diverted to the industries that have a direct bearing on the prosecution of the war. On the other hand it is urged that all normal industries should be carried forward regularly and that highway improvement should be among these. Whatever may be the decision of the Federal Government on this point, it is probable that scarcity of labor will make some work impossible and that high cost of labor and material will at the very least seriously discourage work during the period of the war.

Whether or not actual construction work is undertaken during the period of the war, preparation for the same should go forward uninterruptedly and all preliminaries should be completed so that when conditions become favorable the work may be undertaken promptly and go forward without delay. It is particularly desirable that all counties anticipate their requirements and present their applications so that they may get their proportionate share of the available funds even though such counties may not be in position to proceed with construction at once or for some time to come.

One of the most important items in highway construction is the character and the adaptability of the material used. In order to satisfactorily test such material, equipment is necessary and men are needed who have made an especial study of the subject. It is proposed to provide these facilities and be in position to undertake this branch of highway work as soon as time and opportunity will permit.

Construction and maintenance of any kind in order that it be conducted efficiently and economically requires that costs be kept accurately and so segregated that the exact cost of each item is accurately shown. In this respect present methods in highway work are even more lax than in any one other particular. There is not one county in the State that can be said to have even an approximately efficient system of Cost Records. To correct this condition; to furnish counties complete and satisfactory methods of keeping construction and maintenance costs; to make these systems uniform for all counties so as to facilitate comparison; to keep a central system of Comparative Cost Records, and to keep the expenditures of the Commission itself carefully segregated, is one of the important specific purposes set for itself by the Commission.

A good man had been secured for this work and considerable progress had been made in working out its problems. Unfortunately the services of this man were requisitioned by the Federal Trade Commission so that this work will have to be held over until another man competent to handle it can be secured.

A careful study of past experience shows that methods of approaching highway construction work are irregular and extremely

varied. The class and character of the equipment that is used and the manner in which the work is organized and handled have an important bearing on its economy and success. It is believed that a careful investigation of this subject offers opportunity for great improvement and economy. To place at the disposal of County Commissioners construction organizations and equipment in position to give them efficient results and to place the State Commission in position to secure satisfactory contract prices, it is proposed to give careful attention and study to development of construction organizations with a special view to efficiency.

Just as construction organizations as now available are not wholly satisfactory and efficient, so also are stock appliances now available not wholly satisfactory. It is proposed as soon as the development of other lines of work has sufficiently progressed, to undertake an especial study of appliances and to develop such changed and standardized appliances as study and experience prove to give the best results.

In order that any of the work outlined and planned in the foregoing may bring results, it must be brought before the public. To accomplish this in the most satisfactory manner and at the smallest expense, will be given special and careful attention.

With a view to carrying out the policy outlined in the foregoing and prosecuting the work indicated, an organization is being perfected with a view to dividing the work under specific heads as follows:

- I. Developing Road Construction and Maintenance Standards. Introducing Standardizations.
- II. Developing and Introducing Bridge Standardization. Standardization and Supervising Bridge Construction.
- III. Initiating and Administering Federal Aid Projects. Developing System of Road Mapping and Records.
- IV. Testing Road Material.
- V. Developing and Introducing a Uniform System of Cost Records.
- VI. Developing Construction Organizations and Carrying on State Aid Operations.
- VII. Developing Appliances.
- VIII. Information.

The importance of the work herein outlined becomes apparent when it is remembered that there is being raised and expended annually in the State of Montana for road and street improvement a sum estimated at \$3,500,000.00. To make this vast sum effective; to make it yield the greatest possible returns in road values; to find ways of making one dollar do the work now done by two, and in many instances by three or four,—that is the highway problem of Montana and the

problem that confronts the Commission. As compared with the additional road that can be built by increasing efficiency in the use of these great sums, the road that could be built with the amount at the disposal of the Commission is of significant importance.

The plans herein outlined contemplate that the Highway Commission will be the Engineering Department for the highway work of the State. In this and in its method of organization it will pattern after what long years of experience have proven to be the best methods in the sister problem, that of Railway Engineering. It will be in position to do this work far more thoroughly and at much less total cost than can be done in any other than a state wide way. It will do the work more thoroughly because it can afford to employ the highest type of engineering talent available. And it will do it more cheaply because the work once done will serve equally well each of the forty-three individual counties in the State.

From the foregoing it will be plain to every thinking man not only that every dollar expended by the Commission is expended directly in highway construction, but that it is spent directly in construction in a way that insures its yielding the greatest possible returns.

The Commission fully realizes the magnitude of the task it is undertaking and the difficulties to be met, some of which must necessarily take much time and patience to work out. It faces the task, however, with the conviction that there is no undertaking that means more to the welfare and the future of the State of Montana and that by approaching the work in a deliberate, well considered and well planned manner, striking directly at the root of present difficulties, it is building on a sound foundation and one that with perseverance and determination must lead to success in a large way.

**SECOND ANNUAL STATEMENT OF THE HIGHWAY COMMISSION
OF THE STATE OF MONTANA, FROM NOVEMBER 30, 1917,
TO NOVEMBER 30, 1918.**

To His Excellency, S. V. Stewart,
Governor of Montana.

The State Highway Commission begs herewith to submit a brief outline of its operations for the fiscal year ending November 30th, 1918. Detailed reports of the activities of its different departments are on file in the office of the commission and inspection of them by anyone interested is cordially invited.

The origin of the Commission, its organization and personnel are fully set forth in the First Annual Statement, a copy of which is here-to attached, and will not be here repeated. The terms of office of the Commissioners for Districts Nos. 2, 7 and 10 having expired on May 1st, 1918, Messrs. D. T. Curran, C. W. Morrison and E. A. Richardson, the past incumbents were reappointed for a four-year term. Mr. F. H. Johnson, Commissioner for District No. 1, having removed from the District, resigned and Mr. A. V. Gibson of Kalispell was appointed to fill the vacancy thus created.

To review the work of the Commission intelligently, it is necessary to bear in mind facts set forth in its statement for 1917, and particularly the following:

The State of Montana collects annually thru its counties and expends on bridges and highways in excess of \$3,500,000. To work out and establish a system of highway management and to work out methods of highway improvement and maintenance that will result in increasingly greater returns year by year for this vast expenditure is the real highway problem of Montana. The Commission is called upon to carry out extensive construction and maintenance operations in connection with the administration of Federal Aid and State Aid projects. And while these operations will be of great importance in testing out methods under consideration, in demonstrating methods adopted, and in training men to carry them out, such construction and maintenance work is, nevertheless, secondary to the larger work above outlined; namely that of getting results for the vast sums expended by counties and cities on highway improvement.

To realize the difficulties presented by the work it may be well to bear in mind that although the problem of providing Montana with an efficient highway improvement and maintenance system has been wrestled with for the past thirty years and has commanded endless thought and study, comparatively little practical progress has been made in its solution. It must be evident then that this problem cannot be simple of solution, and that it must not be expected to be mastered quickly and easily. Its eventually successful solution necessarily depends upon, first, the development of sound basic principles and second, the development of a competent and efficient working organiza-

tion. The policy of the Commission is founded upon this conception. Its purpose is to take the system now established, to analyze and isolate its shortcomings and to work out correctives,—and thus by conservative, constructive work to bring about gradual continuous improvement and upbuilding.

An analysis of the highway situation: Segregation of the problems involved and plans and policies of the Commission for meeting these problems were fully set forth in the statement for 1917. These plans and policies have been rigidly adhered to and consistently developed in the past year's work.

Unfortunately war conditions have very greatly interfered with the work, first, by making it impossible to secure men of the education and training necessary to carry out the work planned, and secondly making it impossible to secure labor and material to carry out construction and maintenance work decided upon. Not only has it been impossible to secure men to complete the organization, but such organization as has been available has been extensively used for direct war activities. Also war work has disrupted the organization repeatedly by taking away men after they have been given considerable experience and training for their position.

In spite of the difficulties inherent in the work and the added draw-backs due to war conditions, the Commission feels that it has made a thoroughly creditable start and substantial progress as will be seen from the following discussion of its accomplishment in each of the important divisions of work undertaken. These divisions as outlined in the earlier report are as follows:

- I. Developing Road Construction and Maintenance Standards.
- II. Developing and Introducing Bridge Standardization and Supervising Bridge Construction.
- III. Initiating and Administering Federal Aid Projects. Developing System of Road Mapping and Records.
- IV. Testing Road Materials.
- V. Developing and Introducing a Uniform System of Cost Records.
- VI. Developing Construction Organization and Carrying on State Aid Operations.
- VII. Developing Appliances.
- VIII. Information.

I. Construction and Maintenance Standardization.

The work of this division is decidedly the most important of all work undertaken, and is at the same time the work which is least amenable to quick and positive prosecution.

As a basis for this work, information and data must be collected extending over wide areas and a great range of conditions. Such data must then be worked over and translated into tangible and definite conclusions, and these conclusions must be brought home to the public.

In line with this the Commission has secured the services of a number of men who have had extensive experience in highway work. In short, it has secured the best men that are available in the State. These men, designated as District Engineers, have been kept in the field to confer with County Commissioners and county road builders and advise with them on problems with which the latter have found themselves confronted. In turn these District Engineers meet in conference with each other and the Chief Engineer and discuss and work over problems that come before them. Thus has been created a clearing-house for ideas and a means of disseminating information which has already produced tangible results and which will be of increasing importance as the experience of these engineers multiplies. More than this, it works toward a general agreement upon best methods to be adopted as standards for the State and it lays the foundation for a closer co-operation between the highway forces of the counties and for a welding of these into a unified and well organized system.

A most gratifying and encouraging feature of this work is the spirit of hearty co-operation and mutual interest that is developing between the County Commissioners and the members of the Commission staff. If this department of the Commission had done nothing else, the results in this one direction would well repay the effort spent.

After developing standards, the next important step in the work under this division is that of training men. This phase of the work could not be given the attention during the past year that it merited. First, because methods had not yet been sufficiently worked out to be ready for satisfactory presentation, and secondly, because owing to the draft for military service, young men were not available for training. It is hoped that the return of normal conditions will make it possible to proceed with this work in the near future and plans are being laid to push it vigorously and systematically during the coming season.

II. Bridge Standardization and Supervision.

The activities and the organization of the Bridge Department are described in considerable detail in the report for 1917. These activities have been continued throughout the past year. The work of the Department has been materially broadened and extended. Construction standards have been reviewed and revised. New and additional standards have been de-

veloped. The work of the Department has been developed particularly in the direction of more complete and detailed investigation of bridge sites, with a view to securing not only more permanent foundations but also greater protection for the structure by stream control. Special designs have been prepared for specific conditions. Two of these embrace the construction of elaborate concrete structures for Cascade County involving an expenditure of over one-half million dollars. One of the large problems presented to the Department during the past year embraced extensive flood control and bridge replacement due to destruction by floods of the Yellowstone River early in the Season.

A brief summary of details of the work of the Bridge Department and construction costs involved is as follows:

Number of bridges for which plans were provided, 39; Total estimated construction cost involved, \$842,635.00; number of bridges supervised by Commission, 9; Total construction cost, \$88,835.00; Number of structures for which plans were provided and construction deferred, 20; Total estimated construction cost involved, \$658,100.00.

III. Federal Aid. It was explained in the report for 1917 that by an Act of Congress known as the Federal Aid Act there was appropriated the sum of \$85,000,000.00, to be expended in the course of five years from 1917 to 1921 inclusive on road construction in different states of the Union. Under this Act Montana is entitled to approximately \$1,500,000.00 during the five years named.

The Act requires, however, that in order to secure this appropriation the State must provide an equal amount. The last Legislature in passing the Act providing for the present Highway Commission charged the Commission with obtaining for the State the full benefits of the said Act of Congress, but it did not provide funds to meet the co-operation required of the State. It has therefore been incumbent upon the Commission to devise ways and means whereby this Federal money could be made available. The problem has been solved by securing the co-operation of the counties individually. It has been pointed out that by taking advantage of this aid, individual counties could carry out improvements otherwise impossible. The conditions under which Federal Aid is granted are exacting and necessitate a large amount of work. The State Highway Commission is made responsible for this work both by the National Federal Aid Act and by the State Highway Commission Act. In order to carry out these provisions the Commission must proceed as follows: First, it must look into the needs of the different counties and work out with them the initiation of projects. Second, after the filing of a formal application by a county, the Commission must send out a man to make a general examination and to collect the data necessary for the preparation of a so-called "Project Statement." This project statement is forwarded to the "Federal District Engineer" stationed at Portland. When a number of project

statements have accumulated so as to make the trip worth while, the District Engineer makes a preliminary inspection. After adjustment of exceptions and differences the District Engineer makes recommendations to the Washington office. If the project is then approved by the Secretary of Agriculture the Commission is compelled to send out a survey party, and prepare an elaborate detailed survey with plans and specifications prepared according to forms prescribed by the Department. This involves a large amount of detailed work and when these plans are finally completed they are forwarded to the District Engineer who makes a second field inspection. If the plans then meet his approval he forwards them to the Washington office with recommendations. The approval is then required; first, of the Chief Engineer of the Bureau of Public Roads, then of the Director of the Bureau of Public Roads and lastly of the Secretary of Agriculture. All of the foregoing work and procedure is imperative before any construction work can begin and all expense involved therein is borne by the State Highway Commission.

The Commission took hold of the foregoing work early during the past year, with vigor and determination. It has had in the field during the past season from two to four survey parties consisting of five men each. It has had employed from one to five men on reconnaissance surveys and preparation of Project Statements, and it has had at work not less than five men in office work in the preparation of final plans and estimates.

Applications for eighty projects have been filed with the Commission. These cover thirty-three counties out of forty-three. Reconnaissance surveys have been made and Project Statements have been prepared on fifty-five projects. Project Statements have been approved on fourteen projects. Surveys have been made on thirty projects covering two hundred and ten miles of road and bridges and plans and specifications have been submitted on five projects. Final approval of the Secretary of Agriculture has been secured on four projects.

It was the admitted policy of the Bureau of Public Roads to hold back construction work for the time being owing to war conditions. When it became manifest that final approval could not be secured promptly, and in time for 1918 construction, completion of detail plans involving a large amount of office work was deferred and effort was concentrated while the weather was favorable on surveying operations and the gathering of field data. The office work necessary in preparing the final plans will be done during the winter season and specifications will be ready for operation at the opening of the coming season. It is for this reason that plans and specifications have been submitted for but five projects while plans for twenty-five are now being prepared.

The cost of this division of work to date is approximately \$33,000.00. The projects on which statements have been submitted to the

Bureau of Public Roads total a mileage of approximately one hundred eighty-eight and involve an expenditure estimated at \$673,500.00. The total amount involved in all live applications is \$1,243,000.00. It will be seen from the foregoing that it is not due to any lack of initiative or effort on the part of the Commission that Federal Aid projects are not more advanced or that active construction work was not undertaken during the past season.

Unfortunately for Montana the regulations and restrictions under which Federal Aid is administered operate to its disadvantage. In the first place,—the immense area of Montana, the vast mileage of its public highways, the comparative sparsity of its population and the limited funds available for highway construction create an imperative need for a moderate betterment of the largest possible proportion of its total mileage rather than a more intensive improvement of a limited milage. The present policy of the Department of Agriculture in demanding intensive improvement of limited mileage is in direct opposition to the policy of the Commission based upon the foregoing considerations.

In the second place, the application of the fund is restricted to Post Roads only. The postal regulations require an average of not less than four heads of families per mile before rural delivery routes may be established. This applies only to routes not less than ten miles long. On routes of less than this length the average must be six heads of families per mile. Montana with its sparse population, with its enlarged homesteads and extensive ranches can qualify for rural free routes in only very restricted districts.

The main state highways and therefore those that should be improved first—in other words, those upon which Federal Aid would naturally be applied—parallel railways in most instances. Inasmuch as the mails are carried by the railways there is no occasion for postal routes on these parallel highways, and they are for this reason not open to Federal Aid improvement. It is therefore evident that this post road restriction is a serious obstacle to the application of Federal Aid in Montana. Fortunately this matter is largely one of interpretation by the Department of Agriculture and does not necessarily require additional legislation. It has been brought to the attention of the Secretary of Agriculture and the latter has given the assurance that he will do everything within his power to co-operate with the Commission for the best possible results. If it is found that the entire elimination of objectionable restriction requires Congressional action, the public of the State and the coming Legislature should stand unitedly behind a movement to secure all concessions necessary to provide for Montana in the largest way the benefits of the Federal Aid Act.

In this connection it is interesting to note that a bill has already been prepared for submission to the present Congress providing for

an additional appropriation of \$600,000,000.00 extended over a period of five years for further Federal Aid. If this money is distributed on the same basis as the original appropriation, Montana's share will be approximately \$12,000,000.00. In view of this prospect the importance of securing a modification of the application of the Federal Aid Act becomes increasingly apparent.

Road Mapping and Records. During the winter of 1917-1918, considerable progress was made in developing a system of road mapping and road records for use of counties. Montana practice in this respect was carefully studied and a working outline of the proposed system prepared. The design of proper forms and actual installation of the new plan was interrupted by the urgency of early spring operations. The use of every available man for work of more immediate importance and the scarcity of engineering-draftsmen made it necessary to postpone consideration of this division of work. At the present time, however, the problem is again receiving attention, and before the end of the winter months plans for a comprehensive and satisfactory system of road records and mapping will be available.

IV. Testing Road Materials. War conditions and the greater urgency of other problems have made it impracticable to devote any considerable time to extensive work under this head, and as yet no mechanical devices for testing materials have been provided.

However the Commission has examined many deposits of surfacing materials and samples therefrom have been subjected to those simpler tests approved by best highway engineering practice. Thus it has been possible to recommend to county officials the use of certain materials that promised superior results and in other cases manipulation or treatment has been suggested that will give satisfactory results from an otherwise questionable material.

Good progress has been made in awaking a realization of the importance of careful examination and selection of material for road surfacing and it is proposed to provide special appliances and machinery for making most complete and exhaustive tests as soon as pressure of other work under way will permit.

V. Accounting and Cost Keeping. The purposes of this subdivision of work are comprehensively set forth on page 29 of the report for 1917. The work was badly interrupted during the earlier part of the year by the fact that the man secured to undertake it was called into the Federal service and that another man was not found for the work until after the middle of the year. Since that time the work has progressed satisfactorily. There has been worked out a system of cost records covering all of the Commission's operations, both construction of roads and bridges and all other of its activities.

There has been worked out a system of records for use in counties covering all highway activities. In this connection it is interesting to

note that while a system of uniform accounting for counties has been prepared and prescribed by the State Examiner through legislative action, such system makes no provision for keeping a record of cost differentiation.

In the absence of such data boards of commissioners are at a disadvantage in the preparation of their plans and budgets for the year's work. They are not in a position to compare the relative efficiency in performance of different pieces of work, and are unable to present a satisfactory statement in justification of expenditures. The system devised is now in use in four different counties. Difficulties have been encountered in the practical application of the system and these are being eliminated as they become apparent.

VI. Developing Construction Organizations and Administering State Aid Operations. Modern highway construction and maintenance on a larger scale by means of machinery and appliances calls for system and organization. To secure the best and most effective results such system and organization must be made the subject of careful thought and study and must be developed and worked out in practical experience.

In the development of a system of main state highways to connect the trade and population centers of the state it is found that in many instances connecting links are required that are of very little local interest or advantage and that have little source of local support. Such highways often run through some mountainous section of a county with no local industry or source of revenue. Sometimes they run across some remote corner of the county while the source of highway revenue and the highway requirements of the taxpayers of the county are in a wholly different direction. Again main highways are used extensively by trans-state and other traffic foreign to the county through which such highways pass. This imposes an additional and rather unfair maintenance burden upon such county, the local benefits of which are not apparent. Scores of instances of this kind can be recalled by anyone conversant with the highway geography of the state.

Unfortunately such highways are rarely open to improvement under the provisions of the Federal Aid Road Act on account of restrictions and regulations governing Federal Aid herein before cited.

The Commission is meeting these two problems and combining with them others hereinafter discussed in the following manner: It is setting aside such funds as can be spared from the basal operations herein outlined, for the working out of a system of State Aid in road improvement. This appropriation is used to defray a part of the cost of the construction and maintenance of the connecting links of the State Highway system above described on condition that the county furnishes the balance.

These State Aid Projects are being constructed by the forces of the Commission with a view to accomplishing the following purposes:

1. To secure the greatest possible returns for the money thus expended.
2. To develop and test out by experience methods of organization and systems of conducting highway work.
3. To demonstrate these methods of work and methods of organization.
4. To provide a practical training school for operators.

State Aid therefore in addition to making it possible to fill in connecting links in State Highways serves to work out and test by actual experience methods of organization and of operation and serves to demonstrate these methods and to train practical road builders in their application.

This division of the Commission's work as all other departments, and particularly Federal Aid, has been hampered during the past year by war conditions. Nevertheless ten State Aid Projects have been initiated and upon six of these construction has been undertaken. The total estimated cost of all State Aid Projects is \$193,000.00, approximately \$72,000.00 of which represents the aid provided by the State. Funds for use upon State Aid Projects were made available by the Commission in May, 1918, at which time approximately \$100,000.00 was appropriated for state aid improvement. This appropriation was divided into four equal parts, each of which was set aside for use in one of the four quarters of the state. To date the Commission has expended \$36,880.94 upon state aid projects.

There is a very great need for a connecting link between Belton and Glacier Park station, both lying upon the trans-continental highway in the northern part of the state, but upon opposite sides of the continental divide. The work of opening a road at this point involved the location and construction of approximately fifty-seven miles of highway across the main range of the Rocky Mountains at the southern boundary of Glacier National Park. The fund at the disposal of the Commission for this project being wholly inadequate, an amount of \$15,000.00 was set aside upon condition that certain additional funds would be contributed by counties and cities interested in the success of the project. Flathead County has therefore appropriated \$10,000.00; Teton County has appropriated \$12,500.00; the National Forest Service \$12,500.00; the City of Kalispell \$5,000.00, and communities interested have promised additional subscriptions. There has thus been provided a fund of approximately \$55,000.00. While it is recognized that this fund is not sufficient for the construction of a wholly satisfactory road through the entire distance it has nevertheless enabled a very substantial start to be made toward the construction of this important highway and serves as a foundation for similar financing to complete

the work. In the same section of the state, state aid is being applied on a portion of the same state highway in Lincoln County in the amount of \$5,000.00.

In the southwestern part of the state there is but a single east and west state highway, which carries a great volume of through traffic in addition to its normal local traffic. The maintenance of this road is expensive and burdensome to the counties through which it passes. Two state aid projects have therefore been initiated for the purpose of rebuilding this highway between Garrison and Drummond. Work was prosecuted on this project during the past season and a considerable portion of the entire length of road has been reshaped and surfaced with gravel.

In the northeastern portion of the state, in Blaine and Valley Counties, three state aid projects are now in course of construction, each project being a needed improvement to link in the trans-continental as well as main state highway.

State aid projects in Carter, Fallon and Custer Counties in the Southeastern section of the state, have progressed to a point where construction will begin as early in the spring of 1919 as weather conditions will permit.

The system of state aid inaugurated by the Commission as herein outlined serves as a concrete means for effectively developing and expanding all the functions of the Commission. This division of work is already demonstrating its importance and must become of greater consequence as experience accumulates and as funds in increasing amounts become available to support it.

VII. Developing Appliances. In accordance with the policy outlined in the First Annual Statement the matter of improving and developing appliances has been deferred until such time as other and more urgent divisions of work will permit of a proper consideration of the problem. Experience of the past season has strengthened the conviction that this is an important feature of the program and it will have proper and serious attention just as soon as conditions justify.

VIII. Information. The First Annual Statement calls attention to the fact that if the work of the Commission is to be fruitful of best results it must be brought to the attention of the public in a proper and legitimate manner. It is recognized that the entire state is interested in the plans of the Commission and the degree of success attending their prosecution. During the past year the newspapers have been relied upon to present interesting phases of Commission activities and their courteous assistance in this regard has merited the appreciation of the Commission. However there must be some more direct and flexible means of disseminating pertinent information. Following the plan adopted in many other states, the Commission will shortly begin the publication and distribution of service bulletins, in which will be

presented an outline of the Commission's work and progress as well as useful items of information and specific matters of particular interest to local road officials. Arrangements are now being perfected that assure the inauguration of this practice in time to cover spring maintenance problems that will ere long confront the counties of the state.

IX. Federal Collaboration. It has been stated elsewhere in this report that war requirements of the Federal Government necessitated a restriction of highway and bridge activities. So pronounced was this policy of restriction that during the greater portion of the past working season, cities and counties were required to secure a permit from the United States Highways Council, before proceeding with any street, road, bridge or culvert project that involved the use of materials, labor and transportation needed for war purposes. The regulations of the United States Highway Council required that all applications for permits for Montana projects be reviewed and passed upon by the State Highway Commission before being transmitted to Washington. The Commission therefore became a governmental agency charged with the duty of enforcing the policy and regulations of a properly constituted federal authority.

The work thus imposed upon the Commission had assumed large proportions before the signing of the armistice removed the necessity for further restrictions. Every assistance was rendered local officials in the preparation of applications for permits. Members of the staff were engaged in making field inspection of projects proposed by cities and counties. In addition the Commission was ordered to prepare and submit a state program for 1919, including all city, county and state projects proposed for the purpose of constructing, repairing or maintaining any road, bridge or street. This one phase of federal collaboration was a task of considerable magnitude, involving as it did co-operation with every city, town and county in the state.

The Commission has regarded this feature of its activities as a patriotic contribution to the success of the war, and has prosecuted the work incidental thereto willingly and vigorously. All the expense involved in the details of federal collaboration and co-operation was borne by the Commission.

In order to analyze the work of the commission and to lay the foundation for considering and discussing it intelligently, its activities have been subdivided into the different divisions of work herein discussed. It will be seen, however, that there can be no definite lines of demarcation between them. In the same manner the organization of the staff of the Commission is not definitely segregated along the lines indicated. Each man is required to perform such duties as he is best qualified for, and as most readily can be combined in the interest of efficiency and economy.

It has been stated at the outset that the work of the Commission involves a multitude of different and difficult problems. These can only be worked out by starting at the bottom, by proceeding upon sound and correct fundamental principles, and through careful, painstaking work, building up a gradual systematic improvement. This is the policy and system under which the Commission is proceeding and toward which it feels that it has made encouraging and satisfactory progress.

SUMMARY OF MAJOR OPERATIONS.

The present Federal Aid Road Act apportions to Montana the sum of approximately \$1,500,000.00 to be met by an equal amount from the State.

The State Highway Commission is made responsible for this work both by the Federal Aid Act and the State Highway Commission Act.

All surveys and plans must be made according to Federal regulations before the projects will be approved and money made available for same.

FEDERAL AID OPERATIONS.

Received 80 applications from 33 Counties involving 741 miles of highway construction at an estimated cost of \$1,572,111.

Reconnaissance made on 54 projects in 25 Counties involving 556 miles of road at an estimated construction cost of \$1,188,657.

Submitted to Federal authorities 30 projects in 18 Counties covering 188 miles of road involving an estimated construction cost of \$673,565.00.

Eleven projects in 7 Counties under preparation to be submitted to Federal authorities within 30 days involving an estimated construction cost of \$341,302.00.

STATE AID OPERATIONS.

Initiated 10 projects in 12 Counties involving 186.5 miles of State Highway where Federal Aid will not apply.

Commission appropriated from its funds \$72,200.00 for this work against \$121,300.00 appropriated by the Counties.

Road work operations for 1918, limited by conditions, as follows:

State roads reshaped	37 miles
State roads graded	24 miles
State roads graded and gravelled.....	13.5 miles
State road construction on new location	8 miles
Total road improvement by Commission	82.5 miles

BRIDGE DESIGN AND SUPERVISION.

Plans for 39 bridges have been provided for various Counties involving an estimated construction cost of \$842,635.00.

Construction of 9 bridges have been supervised.

Plans have been provided for 20 structures involving an estimated construction cost of \$658,100.00 on which construction has been deferred.

FINANCIAL STATEMENT.

INCOME:

Balance in Highway Fund May 1st, 1917.....	\$ 27,277.19
Gross Income from Motor Vehicle Fees for the years 1917 and 1918.....	645,985.50
Total Fund of	\$673,262.69

EXPENDITURES:

Expended by the Secretary of State for Ad- ministration of the Act	\$ 57,891.19
Amount returned to Counties in 1917 by the Secretary of State	65,194.55
Amount to be returned to Counties in 1918 by the Secretary of State (est)	80,215.54
Amount returned to Counties for 1917 by Highway Commission	65,207.92
Amount to be returned to Counties for 1918 by Highway Commission (est)	80,215.54
Total Amount returned to Counties and Secre- tary of State's Expense.....	\$348,724.74
Net amount Available for Highway Commission.....	\$324,537.95

FINANCIAL OPERATIONS OF STATE HIGHWAY COMMISSION:

General Commission Expense	\$ 4,804.56
Administrative Expense for 1917-1918	4,388.23
Administration of Federal Aid under Regulation of Federal Government	32,999.20
Bridge Design, Inspection and Supervision of Construction.....	36,589.30
County Co-operation	5,810.39
Investment in Equipment and Machinery	31,572.53
Unpaid Accounts of former Commission and War Activities.....	3,239.14
State Aid Operations	36,880.94
Unexpended Appropriations for State Aid Operations.....	41,282.16
Balance of 1918 funds Available for State Aid Operations in 1919	126,991.50

